MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

Steering Group on Food Surveillance

Progress Report 1984

The fourteenth report of the
Steering Group on Food Surveillance

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STEERING GROUP ON FOOD SURVEILLANCE

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Terms of Reference

To keep under review the possibilities of contamination of any part of the national food supply, to review where necessary the intake of individual additives and nutrients and to recommend to Ministers responsible for food quality and safety the programme of work necessary to ensure that the food intake of the population is both safe and nutritious. To appoint expert Working Parties, acting according to such instructions as the Steering Group may give, to carry out specialist parts of the programme of work.

To consider reports made by Working Parties and to decide what action, including consultation with the Government's advisory committees and other bodies having an interest in the subject matter or the implications of the reports, should be recommended.

To submit the findings of the Working Party reports, where appropriate, to the Ministers with appropriate recommendations as to publication.

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INTRODUCTION

1. Within UK Government there is an extensive advisory system on all aspects of food safety, including additives, nutrition, contamination, packaging, labelling and composition. The advice is usually formulated by independent advisory committees. The objective of the system is to ensure that what we eat is safe and nutritious and is what it claims to be. Government agencies therefore monitor the food supply for toxic factors that may occur in food due to disease or environmental contamination. In addition, before substances are permitted for deliberate addition to food, or licensed for use in food animals, or endorsed for use on crops, they are subjected to comprehensive investigation. The food supply must subsequently be monitored to find out whether these substances are used for the intended purpose and in safe quantities. Changes in the food supply and in eating habits alter the intake of nutrients in the diet and this, too, is subject to monitoring. The Steering Group on Food Surveillance is a part of the advisory system. Its main functions are to ensure the development of appropriate analytical methodology and to collect and review information about the concentrations of additives, contaminants and nutrients in the food that we eat.

2. The Steering Group published its first report, *The surveillance of food contamination in the United Kingdom*, in 1978 (Food Surveillance Paper No. 1, HMSO), describing the work it had carried out since its formation in 1971. It also described the position of the Group in relation to other Government Committees and Departments. That relationship has now changed and Appendices I and II give the current relationship between the Steering Group and Expert Committees and Government Departments respectively. Since 1978 the Steering Group has published 12 further reports (Appendix III), each covering particular food contaminants. These reports have dealt with a diverse range of subjects which include migrants from plastic packaging, heavy metals, and pesticide residues and other organic contaminants.

3. In recent years significant developments have taken place in both methods of analysis for food contaminants and in the understanding of toxicology. Moreover the Steering Group has widened the scope of its surveillance work to include food additives and by reorganising the Committees responsible for gathering data on nutrients. Consequently there have been changes in emphasis of the Steering Group's policy and work and in the structure and membership of its Working Parties.

4. In view of the current level of interest in food surveillance, displayed not only by Government, by universities and by the food industry, but also by the general public, the Steering Group has decided to publish this general review of the work being undertaken and the approach adopted.

CHANGES IN ORGANISATION

The Steering Group

5. Since 1978 the surveillance programme has been broadened and the individual investigations into chemicals in food have become more detailed. To cope with these changes, membership has changed and now includes representatives from industry and academia. The Steering Group is no longer

involved with technical detail and is primarily concerned with strategy, priorities and ensuring the effectiveness of its Working Parties.

Working Parties

6. The number of Working Parties has been limited to that consistent with achieving effective investigations whilst ensuring that they retain sufficient members with specialist knowledge. In future, whenever practicable, new topics requiring investigation will be dealt with by an existing Working Party rather than one especially created for the purpose. To achieve this end, some Working Parties have had their remit broadened; for example, the Working Party on Mycotoxins has been incorporated into a new Working Party on Naturally-Occurring Toxicants in Food. To make the best use of scarce resources, each Working Party Chairman has been asked to ensure that membership is kept to the minimum consistent with these objectives.

THE APPROACH TO SURVEILLANCE

7. There is no one approach to surveillance investigations. The Steering Group recognises that Working Parties need to be able to adopt the most appropriate approach to produce a rapid and correct response to problems. However, certain general principles are important:

(a) to design a programme capable of assessing the average daily dietary intake of a chemical of interest;

(b) to survey the concentration of the chemical of interest in major foods in the UK diet;

(c) to determine whether any foods contain especially high concentrations of the chemical or contain the chemical in a particular form or whether the chemical reacts with components of the food and then, where appropriate, study this aspect further;

(d) to survey the dietary intake of the chemical by individuals who might be more at risk than the average person and where appropriate to supplement the measurements by experimental work on absorption by man and by speciation* studies.

8. These principles have led to the development and use of total diet and duplicate diet studies across the spectrum of the Steering Group's programme. They have also encouraged regular surveys of basic foodstuffs for a wide variety of substances, such as pesticides, nutrients and heavy metals. The Steering Group has been active in promoting experimental work to improve analytical methodology, which is particularly important for accurate assessment of substances present in food at low concentrations, and in promoting work on the chemical nature and availability to man of substances in food, which is helpful in assessing their toxic hazard. Where statutory limits are in force a surveillance programme based on these principles may also provide useful information about the efficacy of those limits in addition to that generated by the Food and Drugs Authorities, who have a statutory duty to monitor food at the point of sale for compliance with the relevant food legislation.

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*The determination of the form in which the contaminant or nutrient occurs.

Priorities

9. Factors taken into account by the Steering Group in assessing the priority of a particular problem include:

(a) toxicological advice about potential risks to the health of the consumer;

(b) the body of scientific knowledge and analytical methodology available to tackle the problem effectively;

(c) limitations of the scientific and financial resources available.

There are some problems which must be put very high on the list of priorities. Where there is *prima facie* evidence to suggest that a potential health hazard exists to particular groups of people due, for example, to high levels of a contaminant in the diet, urgent action is always taken. Matters which are the subject of public debate, such as lead, are also given a high priority if there is a need to provide scientific evidence to help to resolve the debate. In the absence of such special factors, the importance of the food in question in the average diet or the size of the population group of interest provides a guideline for the allocation of resources.

Consideration of information from the surveillance programme

10. The Working Parties produce information about specific and general topics in the field of food surveillance. The Steering Group actively encourages the publication of much of this information in the scientific literature so that it can reach as many interested parties as possible. When appropriate, Working Parties also produce reports bringing together the results of their investigations of particular subjects, for example pesticide residues. These reports are considered by the Steering Group and, if accepted, are usually submitted to independent expert committees such as the Food Advisory Committee (FAC)* (up until October 1983 reports were referred to the Food Additives and Contaminants Committee, FACC*) and the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT)*, who make recommendations on any action which may be desirable. In addition, the committees may identify areas where further monitoring and research are required. Finally the reports are submitted by the Steering Group to the Parliamentary Secretary seeking endorsement and approval for publication. The recommendations make an important contribution to future policy on food monitoring and research.

ANALYSIS AND SURVEY DESIGN

The limitations of analytical data on chemicals in food

11. Methods of analysis for low levels of chemicals in food are being developed at an increasing pace and encompass an ever widening variety of chemicals. These enable scientists all over the world to generate new information about food contaminants and food composition. Together with surveys commissioned by UK Government they form a growing body of information on the occurrence and concentration of chemicals in food. The apparent observation of previously unsuspected chemicals, albeit at low levels, in staple items of diet or the occasional observation of high concentrations of chemicals in particular foodstuffs which are not important parts of the diet can cause concern,

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*The functions of these committees are outlined in Appendix IV.

particularly in the Press and among the public. Whilst such concern may occasionally be well founded, it is often misplaced because the observation has not been put in perspective, or because there has been contamination during sampling or because the accuracy, reproducibility and precision of the observation have not been tested. It is extremely important that laboratories measuring chemicals in food have adequate internal quality assurance procedures and that when dietary intake is estimated from analytical observations the accuracy of those observations is beyond question. Wherever possible laboratories producing results from the analysis of chemicals in food should take part in external quality assurance programmes to be sure of the accuracy, reproducibility and precision of their methods. If practicable, laboratories should also take part in international comparison programmes which will help to ensure that the quality of the data they produce is at least as good as that from other countries. The Steering Group places particular emphasis on these factors to produce, within current scientific limitations, the most representative and reliable estimates of the concentrations and intake of constituents in the UK food supply.

12. The degree of control exercised over the analyses depends to some extent upon the concentration of the chemical being determined. For example contaminants such as lead or dieldrin tend to occur in food at concentrations close to or at the limit of determination of present analytical methodology. In these instances the uncertainty in measurements will be considerable even with careful control of the methodology; without careful control the measurements will be valueless. In practice it is possible to estimate a concentration with a reasonable degree of confidence provided that it is about five to ten times greater than the limit of detection of the analytical method used. Much of the current and past published information on chemicals in food was produced without rigorous quality control or by methods which although adequate once, would not be considered so now. There is a need to be sure of the reliability of published information before using it as a basis for making decisions for action. The Steering Group aims to obtain a sufficient body of accurate, reliable information to permit valid judgements to be made.

Dietary studies

13. Dietary studies are made to provide information about intakes of chemicals in the mixture of food which forms the diet of the 'average UK consumer' or of particular sections of the population. The total diet study is used to assess average dietary intakes of chemicals while duplicate diet studies are used to assess intakes of special groups. Information on intakes generated by these studies is used by medical specialists in assessing risks to health and may be compared with internationally accepted norms for maximum or minimum intakes or both where they exist. Thus for a food additive, a pesticide, or a food contaminant, results generated from dietary studies are initially compared with the FAO/WHO acceptable daily intake* or the provisional tolerable weekly intake** where these

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*The Acceptable Daily Intake (ADI) of a chemical is the daily intake which, during an entire lifetime, appears to be without appreciable risk on the basis of all known facts at the time.

**The Provisional Tolerable Weekly Intake is akin to the ADI but is usually applied to metallic contaminants. Because of the cumulative character of metallic contaminants it was considered that intake should be expressed over a longer period than a single day. 'Tolerable' signifies permissibility rather than acceptability. 'Provisional' expresses the tentative nature of the evaluation.

have been determined. The comparison provides an indication of the need for action, although the final decision on what action should be taken is usually based on medical advice. The two types of dietary study most often used by the Steering Group are outlined below.

Total Diet Study

14. When worldwide concern first arose about the amounts of pesticide residues that might remain in food, surveys were carried out in Britain on selected foods that were prone to contamination. Limited facilities meant that sampling was restricted, for example to foods important in the diets of babies or other vulnerable groups, and to foods likely to be eaten without washing or other preparative procedures that might have removed residues. Such studies were useful for estimating risks in special situations, but by 1966 the need to determine the average or background exposure of the general population had arisen. The total diet study, similar to American 'market basket' studies, was set up for this purpose initially for pesticides, and has since been emulated in other countries.

15. The total diet study is still conducted in Great Britain, its scope has now been increased and includes the estimation of heavy metals, nutrients and organic constituents other than pesticides as described elsewhere in this Report. This and the need for more flexibility has led to some reorganisation of the study[1]. It remains a study in which specified amounts of selected foods representing the national average diet are purchased in selected towns throughout Britain, then prepared and cooked if necessary as if for eating and finally combined into groups for chemical analysis. Currently, 115 foods are bought by a market research agency in 24 towns each year, and prepared and combined into 20 groups of related foods by the Home Food Science Section of the Long Ashton Research Station. Analyses for specified constituents are then conducted by the Laboratory of the Government Chemist and the MAFF Food Science Laboratory. In some instances several food groups may be combined to reduce the cost and the work necessary for the analyses. The results are published in Steering Group Reports and in the scientific press. By way of example results for the analysis of 1981 total diets for zinc are presented in Table 1.

16. The principal advantage of the total diet study is that the analysis of a relatively small number of samples yields sufficient information to give an approximate daily intake. The small number of food composites required to represent the total diet allows larger numbers of total diets to be collected and analysed than would be the case if samples of individual foods were analysed. The main disadvantage of the total diet study is that certain foods which are consumed at a low rate by the population are included as a small fraction of the composite. In practice this means that, even if a minor item of the diet was contaminated, the contribution made by the food to the concentration of the contaminant in the composite would be so diluted that it might not be detectable. A further disadvantage of the total diet study is that it does not take account of differences in dietary habits within the population. For example infants, vegetarians and certain ethnic groups eat diets which are very different from the total diet. In these instances the duplicate diet study is used to determine intakes.

Duplicate Diet Study

17. A duplicate diet study provides information about the intake of a chemical in food by individuals, in contrast to the information on national average intakes

Table 1 Total dietary intake of zinc, 1981 revised total diet study

Food Group	Consumption (kg/day)	Mean zinc concentration (mg/kg*) **	Mean zinc intake (mg/day)
Bread and cereals	0·240	8·50	2·04
Meat and poultry	0·058	38·2	2·22
Offal	0·003	46·7	0·14
Meat products	0·077	19·0	1·46
Fish	0·015	6·85	0·10
Oils	0·090	9·10	0·82
Sugars and preserves	0·095	2·84	0·27
Green vegetables	0·046	3·38	0·16
Potatoes	0·159	2·74	0·44
Other vegetables	0·068	2·68	0·18
Canned vegetables	0·043	4·72	0·20
Fruit	0·060	0·74	0·04
Fruit products	0·024	1·40	0·03
Beverages	0·118	0·26	0·21†
Milk	0·360	3·79	1·36
TOTALS	**1·456**		**9·7**

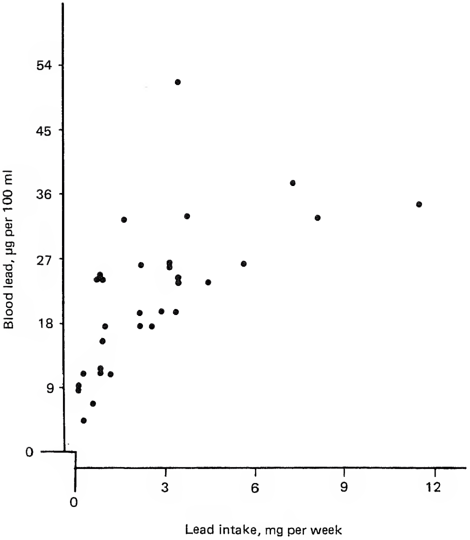
* Means calculated from the results of the analyses of 10 total diets.

† Calculated after allowing for a six-fold dilution of the beverages group.

** In this report the units of concentration of substances in food are expressed as mg/kg (milligrams per kilogram) or μg/kg (micrograms per kilogram). In other publications mg/kg may be referred to as ppm (parts per million) and μg/kg as ppb (parts per billion).

provided by the total diet study. A duplicate diet study is made when people are considered to be at possible risk because they have unusual dietary habits, or because they consume locally-produced food known to be contaminated, or both. A duplicate diet is a replicate of the whole or part of a diet consumed by an individual. The advantages of the duplicate diet study are that analyses are undertaken on a replicate of the food actually eaten by an individual and that comparatively few resources are necessary for its use in estimating exposure in small groups. The principal disadvantages of the study are that it can rarely be carried out for more than seven days – to do more would be asking too much of the participant – therefore the diet may not be representative of what is usually eaten, and there are uncertainties of whether the duplicate diet is as large as the diet actually eaten, since people are reluctant to 'throw-away' good food.

18. Results from duplicate diet studies have, for instance, provided information helpful in the construction of dose-response curves for heavy metals. Results from one such study[18] are given in Figure 1, which shows a plot of blood-lead concentrations versus dietary intake of lead. The data relate to women of child-bearing age, most of whom lived in dwellings receiving a plumbosolvent water supply (that is, water in which lead dissolves easily) through lead pipes. The duplicate diets contained food and drinks made with tap-water. Although there is some scatter in the data, they indicate that there is a relationship between concentration of lead in blood and intake of lead from food and water over the observed range of intakes. In practice, grossly elevated intakes of lead, such as those found in this study, have been observed only in people living in dwellings fitted with lead pipes and receiving plumbosolvent water. As a result of this study lead intakes have been greatly reduced following action by the local water authorities to increase the pH of the water and thus reduce plumbsolvency.



Adult women living in dwellings
fitted with lead pipes and receiving
plumbosolvent water

Fig. 1 Blood lead concentration vs. lead intake.

WORKING PARTIES REPORTING TO THE STEERING GROUP

19. The Steering Group refers problems requiring assessment to one of its Working Parties, which have or can co-opt members with the necessary expert knowledge. Each Working Party keeps its area under review and, to fulfill its responsibilities, suggests work which should be done. It is considered that the limited resources of the Steering Group must be deployed so as to meet best the needs of the time but without losing sight of either the well known areas of concern or of emergent or potential problems. To achieve this end the Steering Group has instituted cyclical reviews of the programmes of each Working Party and decides priorities within the total programme. Most Working Parties are now generic, but those which have been or are asked to tackle specific problems are disbanded once their investigations have concluded. The following sub-sections summarise the current programmes and major work areas of each of the Working Parties now reporting to the Steering Group. The terms of reference, Chairmen and Secretaries of the Working Parties are given in Appendix V.

Working Party on Veterinary Residues in Animal Products

20. This was formed in 1977 to assess the extent to which residues of drugs used in animal health and growth promotion were likely to be present in meat and meat products. The remit has now been extended to include all edible animal products (meat, offal, eggs and milk). A wide variety of drugs is used in animals. Antimicrobial agents, including antibiotics, are used to treat and prevent animal diseases caused by micro-organisms. Anthelmintics are used against parasitic flukes and worms. The term 'veterinary drugs' also includes agents that promote improved conversion of the energy in feed to meat in the animal. Such agents may act hormonally (anabolic substances) or by reducing pathogen activity in the animal's gut.

21. Legislation covering the licensing of medicines, both for human and veterinary use, is governed by the Medicines Act 1968. The system of control is based on certificates or licences without which products may not be tested or marketed. These are issued by the medicines licensing authority which may seek the advice of its independent advisory committee – the Veterinary Products Committee. This was set up under Section 4 of the Act to advise the licensing authority on aspects of safety, quality and efficacy. Safety is legally defined very broadly and includes safety for the target animal, the consumer, the operator and the environment. In order to safeguard the consumer against the presence of potentially harmful residues, a withdrawal period is stipulated after the last treatment with the product, during which time animals must not be slaughtered, or milk or eggs taken for human consumption. The Working Party acts independently of the process of licensing but it can provide data to the licensing authority on the residual levels of drugs in food arising from their actual usage. The Working Party works closely with MAFF Investigation Officers. Where high residue levels of a licensed product or residues of a substance not part of a licensed product may be detected the circumstances leading to the occurrence can be investigated.

22. Information has been gathered from published sources and from industry on the residue levels likely to arise in food from the use of each major class of veterinary drugs available in this country. In the light of this it was decided to initially concentrate the laboratory resources available to the Working Party in the following areas:

(a) residues of antimicrobial agents, anthelmintic agents and hormonal growth promoters in products from cattle, calves, sheep and pigs;

(b) residues of hormonal and non-hormonal growth promoters, antimicrobial agents and agents used to control coccidiosis and blackhead in poultry; and

(c) residues of antimicrobial agents in farmed trout.

23. Few of the analytical methods that were initially available could detect the low residue concentrations likely to be present and much development work has been necessary. In many cases residue concentrations are less than 1 mg/kg[2] and in some cases residue levels are likely to be less than 1 μg/kg. Adequate detection methods have been developed for residues in animal tissues and fluids of the hormonal agents B-trenbolone and hexoestrol, structurally-related stilbene compounds, sulphonamide antimicrobial agents, arsenic and a number

of agents used in poultry production (dimetridazole, clopidol, amprolium and arprinocid). Details of two of these methods have been published[3, 4]. The efficiency of a widely-used screening method for detecting antimicrobial agents in tissue[5] has also been improved. Current activity includes the development of methods of residue detection for neomycin in milk, for antimicrobial agents used in trout farming, for anthelmintic agents and for the hormonal growth promoter zeranol.

24. In a number of cases it has not been possible to make an adequate assessment of the likely residue of agents arising from usage, because no preliminary results could be obtained. In these cases controlled animal trials have been carried out to provide this missing information. For example, an animal trial showed that the use in chickens of the caponising agent hexoestrol (an agent no longer licensed for use in farm animals in the UK) leads to readily-detectable residues of this compound in chicken leg muscle, liver, visceral fat and neck[6]. This work is presently being followed up by surveillance to ensure that such unlicensed products are not in use. The development of an effective residue-testing programme requires considerable resources since potentially there are a vast number of animals which could be treated by a very wide range of therapeutic substances. A systematic approach to the problem is necessary in which careful thought must be given to priorities in both sampling and analysis.

25. By means of a voluntary scheme operating at slaughterhouses in Great Britain representative samples of sheep, cattle, calves and pigs have been obtained for the National Meat Monitoring Programme. This is a voluntary scheme operating at slaughterhouses in Great Britain. Slaughterhouses are selected to provide samples in a statistically-random fashion. The number of animals sampled each year at a given slaughterhouse is a direct reflection of the throughput of animals. Samples have been taken since 1980. Residues of antimicrobial substances are traditionally detected by the technique of bacterial inhibition[5] and application of the test to meat samples indicates that some 2 per cent of the samples are positive for inhibitory substances. However, this method is unable to quantify or identify the residue present, if any, and chemical or other more specific methods are required before meaningful conclusions can be drawn.

26. Hormonal growth promoters exert effects at very low doses and very sensitive methods are necessary for their detection. Recently radioimmunoassays have been developed for the detection of residues of the stilbene class of growth promoters and surveillance of these residues began under the National Meat Monitoring Programme in 1982. The results indicate that there has been a marked decrease in the incidence of positive residues of stilbene growth promoters in bile from food animals since the prohibition of the use of these substances in May 1982. As is shown in Table 2, the Working Party is continuing to monitor the position as part of its current programme.

Working Party on the Monitoring of Foodstuffs for Heavy Metals and other Inorganic Substances

27. The Working Party was set up at a time when scientists became concerned about mercury in fish. Over the past 15 years the interest in heavy metals has increased with lead and cadmium receiving more attention than the other metals. There was a need for information about the concentrations of heavy metals in

Table 2 Summary of the programme of the Working Party on Veterinary Residues in Animal Products

Class of agent	Animal products	Present Working Party activity
Antimicrobial agents	(Meat, offal, body fluid) (Quadrupeds)	Survey[a]
	(Milk)	Assay method development (Neomycin)
	(Meat or offal) (Poultry)	Survey
	(Edible tissues) (Trout)	Assay method development
Anthelmintic agents	(Offal) (Quadrupeds)	Assay method development
	(Milk)	Assay method development
Hormonal growth promoters	(Meat, offal, body fluid) (Quadrupeds)	Survey[a]
	(Meat) (Poultry)	Survey
Non-hormonal growth promoters	Poultry (Offal)	Survey
Coccidiostats	Poultry (Offal)	Survey
Anti-blackhead agents	Poultry (Offal)	Survey

[a] In association with the State Veterinary Service National Surveillance Scheme for residues in meat with parallel work on developing better assay methods.

foodstuffs and about their dietary intakes by the general population, because there were few reliable data available which could be used in making risk assessments. Reports by the Working Party[7, 8, 9, 10, 11, 12, 13] provided extensive and detailed information. For example it was found[8] in 1972 that the concentration of lead in canned infant food was about 0·24 mg/kg compared with 0·04 mg/kg in bottled infant food. This finding resulted in industry switching to cans made without lead solders and a reduction in the statutory limit for lead in infant food. Canned infant food now contains about the same concentration of lead as other infant food. Research on the biological forms of mercury[7, 9] indicated that people who regularly ate fish would be likely to have elevated intakes of methylmercury, a highly toxic mercury compound. Investigations[14, 15] initiated as a result of these findings showed that, whilst fish consumers did have elevated intakes of methylmercury, the concentration of mercury in their blood was well below the threshold level for toxic effect.

28. Cadmium pollution at the village of Shipham in Somerset aroused much public and scientific interest in the UK. The pollution was associated with old mine workings, and many houses and gardens were sited on the polluted land. Investigations showed[16] that, even though the cadmium content of the soil at Shipham was high, dietary intakes of cadmium by the villagers were less than double the national average intake and had no measurable effect on their health. The cadmium in the soil at Shipham was tightly bound up in minerals and was not readily available for uptake by locally grown produce.

29. Work has been undertaken recently to examine the dose-response relationship for heavy metals in man and the chemical form of compounds

combined with heavy metals in food (see also paragraph 18). Studies of the relationship between dietary lead intake and the concentration of lead in blood have been made[17, 18]. These studies required co-operation between Government Departments (MAFF, DOE, DHSS and SHHD), Local Government (both medical and environmental officials) and investigators from universities and hospitals. Research has also been promoted on the absorption by man of heavy metals from individual foods. For example it has long been known that offal contains higher concentrations of lead than most other foods but it has now been demonstrated[19] that lead in offal is little absorbed by humans. This finding is important for many reasons, among which is the reassurance that if pregnant women are often encouraged to eat offal because it contains high concentrations of important nutrients they will not suffer detrimental effects. It is now clear[19] that the absorption by man of lead and other heavy metals from food is strongly dependent upon, amongst other things, the type of food containing the lead as illustrated in Table 3. Similar investigations have shown that the absorption of cadmium from brown crab meat is about half the currently accepted value for cadmium from food. This work was undertaken because the concentration of cadmium in brown crab meat is higher than in other foods[20].

Table 3 Absorption by man of lead from food

Food consumed	% lead absorbed from the gut, mean	(range)
Tea or coffee	14	(3–28)
Beer	19	(11–23)
Liver or kidney	2·8	(1·6–4·7)
Spinach	5·5	(1·8–14)
Water	63	(59–67)
Various whole meals	5	(2–11)

30. Information generated under the Surveillance programme was used by the FACC and the COT in the recent reviews of the Arsenic in Food Regulations and of Metals in Canned Foods as well as by the Royal Commission on Environmental Pollution in its recent report on lead. The former have also commented on reports prepared by the Working Party. In general the comments on the most recent reports[12, 13, 20, 21] have asked for continued monitoring of the diet but with particular emphasis on special groups of people who have atypical dietary habits, for example vegetarians, and people who may be more at risk from heavy metals such as young children or pregnant women. Work is being undertaken to comply with these requests. The Committees have also asked for continuing research to identify and eliminate the sources from which food is contaminated with lead and cadmium, and such action is continuously in hand. For instance about 6 years ago the brewing industry reduced lead contamination of beer before the reduction of statutory limits. Despite this action alcoholic drink, including beer, has been identified[22] as a possible source of elevated blood lead concentrations in men. New investigations have indicated that some beers may receive lead contamination, albeit within the statutory limit, through contact with various pieces of equipment used in its storage and dispense, and the brewing industry is currently taking steps to reduce this contamination.

Working Party on Chemical Contaminants from Food Contact Materials

31. During the last 25–30 years there has been a large increase in the use of plastics, and nowhere has this been more apparent than in the area of food

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packaging. Plastics have been developed which can be used to package the majority of foods and beverages and protect them from environmental contamination. There can be little doubt that the versatility of plastics has led to a significant improvement in both the range and quality of foods available. It is difficult to envisage the evolution of the modern supermarket or freezer centre without their use.

32. The principal structural feature of plastics is that they are made up of very VC in PVC bottles declined from 64·4 mg/kg in April 1974 to 0·15 mg/kg in May small molecule is often referred to as a **monomer**, the production process as **polymerisation**, and the product a **polymer**, or, in its finished form, a plastic. When two or more different monomers react to form the polymer chain, a **copolymer** is produced. At the present time many different polymers and copolymers are used for food packaging. It was quickly discovered during the development of the plastics industry that commercially useful products could only be obtained if certain additives were incorporated into the polymer matrix. Today a wide range of additives is employed for a number of different purposes, e.g. pigments; plasticisers – which enhance the flexibility of plastic films; stabilisers – which afford protection against heat and u.v. light.

33. A major food contact plastic, poly(vinyl chloride) or PVC, was first used for this purpose in the early 1960s. This polymer has several properties which make it attractive as a food packaging material; it is inert, clear, can be heat-sealed and may be moulded into deep shapes. In 1973 it became evident that certain foods packaged in PVC could become contaminated with measurable quantities of the monomer, vinyl chloride (VC) and toxicologists were becoming concerned about the possible hazards associated with exposure to VC. It was considered prudent to investigate the extent to which food in the UK might be contaminated with this monomer and the Working Party on Vinyl Chloride was established.

34. Since that time a number of other monomers widely used in the production of plastics food packaging materials have become subject to toxicological scrutiny. As a result Working Parties were set up to examine vinylidene chloride (1977), acrylonitrile and methacrylonitrile (1976) and styrene (1979). To date, four Working Parties have carried out detailed investigations of particular monomers used in the production of food contact plastics. There are many other monomers and additives which may be used in the production of such plastics. Other chemicals are used in the production of lacquers for food cans, coatings for paper and board, etc. The Steering Group has recognised that it would be impractical to establish individual Working Parties to examine each of these substances in detail. In consequence, it decided to set up a generic Working Party on Chemical Contaminants from Food Contact Materials which will keep under review the possibility of contamination of any part of the UK food supply by chemicals arising from such materials. The formation of the new generic Working Party, which will oversee the area of possible chemical contamination by food contact materials, will enable any future problem to be considered more quickly and more easily. It will permit priorities to be assessed and switched as appropriate and resources to be allocated where they are most needed. Some of the work performed by the former Working Parties is reviewed below.

Vinyl Chloride

35. The principal food contact applications of PVC and its associated copolymers are as bottles, food tubs and flexible film for wrapping, and many

types of food, e.g. concentrated fruit drinks and squashes, cooking oils and margarine, are packaged in these materials. A number of retail surveys of foods and their PVC containers were undertaken between 1974 and 1978 and these demonstrated a very significant reduction in residual VC levels during this period. The magnitude of this reduction may be gauged from the fact that in 1974 only 20 per cent of PVC bottles analysed contained less than 10 mg/kg VC, whereas by early 1977 all of the bottles analysed contained less than 1 mg/kg VC. Figure 2 illustrates this trend in more detail and shows that the average level of VC in PVC bottles declined from 64.4 mg/kg in April 1974 to 0·15 mg/kg in May 1978. During this period there was also a considerable reduction in VC levels in foods packed in PVC containers. Figure 3 shows that VC levels in both concentrated fruit drink and cooking oil fell from over 100 µg/kg in 1974 to

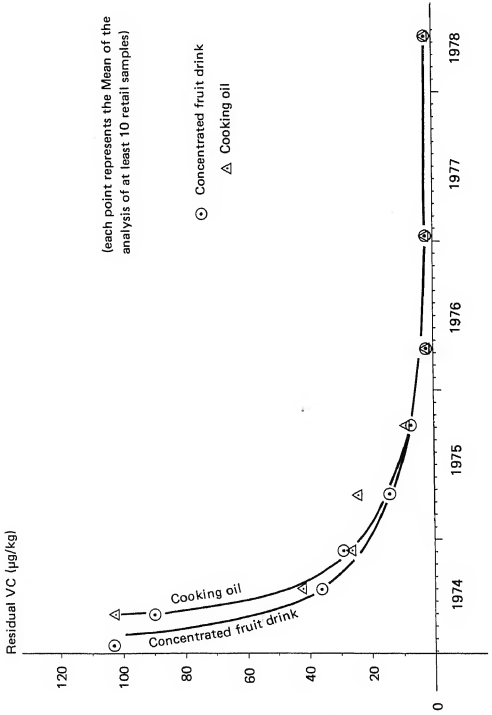


Fig. 2 Levels of residual vinyl chloride (VC) in PVC bottles.

2 μg/kg (the limit of detection of the method of analysis) by 1977. These reductions, together with similar improvements in VC polymers and copolymers used in other food contact applications, resulted in a decrease in the maximum per capita intake of VC in the UK from 1·3 μg/day in 1974 to less than 0·02 μg/day by 1978.

36. A report was published in 1978[23] and since that time VC levels in both food contact materials and in foods have become the subject of EEC-agreed controls. These controls have been implemented in the UK. The Materials and Articles in Contact with Food (Amendment) Regulations 1980 (SI 1980 No. 1838) control the presence of VC in VC polymers and copolymers. The Materials and Articles in Contact with Food (Amendment) Regulations 1982 (SI 1982 No. 1701) control

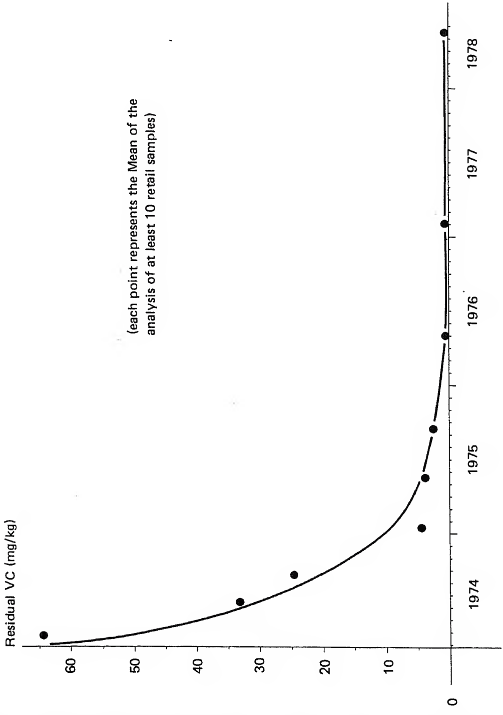


Fig. 3 Levels of residual vinyl chloride (VC) in concentrated fruit drink and cooking oil.

the presence of VC in foods in contact with VC polymers and copolymers. The original Working Party, by acting as a forum for the encouragement and co-ordination of the efforts of the UK plastics industry in reducing the residual VC levels in food contact materials (and consequently in food), proved to be extremely useful in preparing the UK for the introduction of these controls.

Vinylidene Chloride

37. The major food contact application of vinylidene chloride (VDC) is its usage as a comonomer in the production of coatings which may be applied to a variety of packaging materials, e.g. paper, cellulose, plastics. These coated films are used for packaging foods where moisture exclusion or of retention is important, including snack foods, biscuits, cooked meats, cheese, breakfast cereals and confectionery. Retail surveys of foods and packaging were undertaken and it was generally found that the levels of VDC in both the packaging material and the contained food were small, being below the limits of detection of the best available methods of analysis[23a]. It was only possible, therefore, to undertake a crude estimation of the likely per capita intake of VDC. Accordingly, an estimate was based on the assumption that all of the VDC present in food contact materials was available for migration into food and, where the VDC concentration was less than the limit of detection, that the concentration was at the limit of detection. The figure obtained in this way was, necessarily, an overestimate, but, at 1 μg/day, it was still considered to be minute[24].

Acrylonitrile and Methacrylonitrile

38. Acrylonitrile (AN) is widely used as a comonomer in the production of copolymers which exhibit superior properties of toughness, rigidity and resistance to chemical attack. The food contact uses of the various AN copolymers are diverse ranging from packaging materials to kitchenware and household appliances. The most probable source of AN in the diet was found to be the use of acrylonitrile-butadiene-styrene (ABS) containers to package soft margarine. Over the period 1977 to 1984 retail surveys were undertaken of residual AN levels in both food contact materials and foods, particularly margarine[24a]. These demonstrated a marked reduction in AN levels. In 1975, levels of AN in margarine tubs were commonly of the order of 100 mg/kg, but by 1978 the levels had been reduced to 6–8 mg/kg, and in the most recent survey (conducted in April 1984) the average level was 4·2 mg/kg. This trend is illustrated in Figure 4. There has been a corresponding decrease in AN levels in margarine. It was estimated that in 1975 margarine contained approximately 0·35 μg/kg AN whereas by 1984 the average level was 0·011 μg/kg. Indeed, 70 out of 86 samples of margarine analysed did not contain detectable levels of AN (limit of detection 0·01 μg/kg). The maximum likely intake of AN from food in 1975 was estimated to be 2·5 μg/person/day, by November 1979 this had been reduced to 0·3 μg/person/day, and in April 1984 it was estimated to be less than 0·2 μg/person/day. On the basis of this information the Committee on Carcinogenicity considered that the general public are not at measurable risk from acrylonitrile in food[25]. It was found that the only food contact usage of methacrylonitrile (MN) was as an alternative to AN as a comonomer with VDC in the manufacture of coatings for regenerated cellulose films. It was estimated that the maximum possible intake of MN from food would be no greater than 0·0015 μg/person/day.

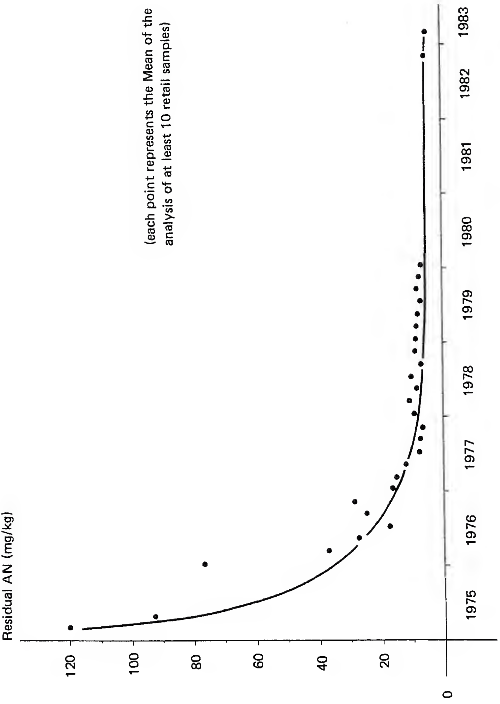


Fig. 4 Levels of residual acrylonitrile (AN) in tubs manufactured using copolymer ABS.

Styrene

39. Styrene is employed in the production of plastics for a wide range of food contact applications. It can be used as the sole monomer in the production of various types of polystyrene or in combination with other monomers such as AN. The food contact uses of the various styrene polymers and copolymers include packaging materials, kitchenware and household appliances, adhesives, can sealants and cargo and storage containers. The usage of styrene polymers and copolymers is now so widespread that, at one time or another, the majority of foods are likely to come into contact with one or more of these, although the conditions of contact may vary from only the briefest association to extended storage in containers made from styrene polymers or copolymers. All foods

which would be expected to make a significant contribution to the total dietary intake of styrene were identified and were examined in retail surveys. From the results of these surveys estimated average and maximum likely per capita intakes of styrene from the average diet were approximately 1 μg/day and 4 μg/day, respectively. On the basis of this information the Committee on Toxicity concluded that the available evidence suggests that the very low levels of styrene found in food, from the migration from food contact materials, do not indicate a hazard for humans[26].

Working Party on Naturally Occurring Toxicants in Food

40. This Working Party was formed in 1982 to assess and, where necessary and practicable, to provide data to assist in the reduction of food contamination in the UK by naturally occurring toxicants. The diet contains thousands of naturally occurring chemicals, the majority of which are normally found in a balanced diet and many of which are essential for life. Some of these chemicals are potentially toxic but in most instances do not pose a risk to the health of the consumer since the more toxic of them form only a small part of the diet. Some chemicals when isolated, produce toxic effects at low doses in experimental animals and humans. These effects may be short-term or long-term. In practice their importance for human health will depend on the amounts consumed in the diet. Food poisoning caused by toxins produced by bacterial contamination of food rapidly produces ill-effects in man whereas other naturally occurring chemical toxicants **may** cause or contribute to illness only if the foods containing them are regularly eaten in quantity for many years.

41. Naturally occurring toxicants provide a challenge to the scientist since they are diverse in their chemical properties and their toxic effects as shown in Figure 5. In some instances the toxicants have not been adequately chemically characterised, for example scombrotoxin, and in other instances they need only be present in minute amounts to cause illness, for example toxicants produced by bacteria. In contrast to many of the adventitious contaminants of food, such as pesticides little is known about the toxic effects of long-term ingestion of some of the naturally occurring components of food. Much scientific research may be required on some of these compounds if their toxic hazard is to be defined. The Working Party has decided that highest priority should be given to work on higher plant toxicants and bacterial toxicants, whilst bearing in mind that considerable work has already been carried out on mycotoxins.

42. The programme of the Working Party has been finalised (Table 4) and laboratory work has started on most of the topics listed. If evidence of a toxic hazard is found in any of the areas defined in Table 4, the means of countering this hazard will depend on the particular circumstances leading to production of the toxicant. In the case of higher plants, plant breeding may offer the best method of reducing toxicant contamination because the toxicants are produced by the plant itself. Care must be taken that new plant varieties do not contain abnormally high levels of possibly toxic natural plant products. For bacterial and fungal toxicants produced during food spoilage, improved storage conditions can reduce spoilage and hence decrease toxicant contamination. Alternatively chemical degradation of natural toxicants can provide an adequate solution. For example, the Working Party has already successfully encouraged the development of a process to degrade aflatoxin in groundnut products[27] to

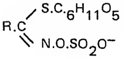
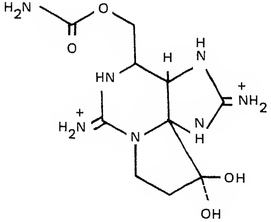
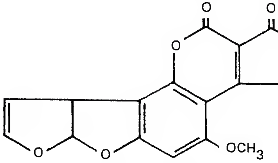
CATEGORY	EXAMPLE	
HIGHER PLANT TOXINS	GLUCOSINOLATES:  $\mathrm{R.C}\begin{array}{l} \diagup \mathrm{S.C_6H_{11}O_5} \\ \diagdown\!\diagdown \mathrm{N.O.SO_2O^-} \end{array}$	Goitrogenic compounds found in Brassicae such as Brussels sprouts, cabbage, radish and mustard
BACTERIAL TOXINS	*Staphylococcus aureus* enterotoxins A to F: Proteins of molecular weight 30,000 to 35,000 (full structures not elucidated)	One cause of food poisoning. Ham, bacon and cold chicken are most commonly associated with food poisoning by *S. aureus* in this country.
PHYCOTOXINS (Produced by Dinoflagellate Plankton)	SAXITOXIN:  H2N O O H H N HN + NH2 + H2N N N H OH OH	One of the agents causing paralytic shellfish poisoning. Has been found in mussels, clams and crab.
MYCOTOXINS (Produced by fungi)	AFLATOXIN B_1 	Carcinogenic. Produced from the mould *Aspergillus flavus*. Has been found in nuts and grains.

Fig. 5 The diversity of toxicants naturally occurring in food.

counteract the contamination of animal feeds which it had earlier demonstrated leads to aflatoxin M_1 contamination of milk. The final approval of the process would allow reintroduction of groundnut meal to animal feedingstuff. It may be possible to repeat this success in the reduction of food contamination by other natural toxicants which are identified as hazardous in the Working Party's newer areas of interest. The work previously carried out on mycotoxins is reviewed in the following section.

Table 4 Summary of the programme of the Working Party on Naturally Occurring Toxicants in Food

Class of agent	Foodstuff or foodstuff raw material used in food production	Working Party activity
Higher plant toxins:		
Glycoalkaloids	Potatoes	Determine levels in retail supply and in different potato varieties
'Bracken toxin'	Milk	Identify toxin 'carried over' from bracken into milk and then determine levels
Glucosinolates	Vegetables (brassicas) and milk	Determine levels in vegetables. Define whether toxin is 'carried over' from animal feed into milk
Pyrrolizidine alkaloids	Legumes, grain and edible animal products	Determine levels in dietary items
Plant oestrogens	Vegetables, grain, beans, fruit and edible animal products	Determine levels in dietary items
Bacterial toxins		Develop rapid and sensitive assay methods to aid industrial quality control and for possible use in survey work
Scombrotoxin	Scombroid fish	Determine levels of indicator compound (histamine) in retail fish samples
Phycotoxins	Ciguatera fish	Determine ciguatoxin levels in certain Carribean fish (if retail samples are available)
Mycotoxins:	1. (*Fusarium* toxins)	Determine levels in grain-based foods. Define methods of toxin degradation, if necessary. Based on data on levels in food and toxicological data, define toxic hazard
	2. (Other mycotoxins)	Survey work on incidence in food and research into the significance of the data and the need for control

Mycotoxins

43. Fungi are naturally occurring organisms and are found widely in the environment. Most fungi are harmless to man. Some microscopic fungi in the genera *Fusarium, Penicillium* and *Aspergillus* can be induced under special laboratory conditions to produce toxic chemicals. These chemicals are known as **mycotoxins**. Mycotoxins are often classified as toxic because of their effects on organisms in laboratory studies, although the results of these studies may not be suitable for estimating risks to human health. Even though a fungus can be induced to produce a mycotoxin in the laboratory this does not mean that the same will happen when food or crops in normal production are infected with the fungus. Only when all the conditions are just right will a mycotoxin be produced.

44. A few mycotoxins are known to be toxic to mammals and **may** pose a health risk to man. One such mycotoxin is aflatoxin B_1 which is sometimes found in groundnuts (peanuts). Groundnut meal is sometimes used in feed for dairy cows and aflatoxin B_1 is converted by the cows to aflatoxin M_1, which in the past has been detected in cows milk. The Working Party on Mycotoxins examined foods susceptible to aflatoxin contamination and the results of this work were reported

to the Steering Group in 1980. This report was published as *Survey of Mycotoxins in the United Kingdom* (Food Surveillance Paper No. 4, HMSO). In commenting on the report the COT considered that it would be prudent to reduce the level of aflatoxin contamination of food to the lowest level that is technologically achievable. In the light of these and other comments the Government took action to limit the import of groundnut meal until the problem of aflatoxin contamination of groundnut meal resulting in traces of aflatoxin M_1 in milk could be solved. Subsequent work has shown[28a] that contamination of milk by the M_1 metabolite of the fungal toxin aflatoxin B_1 and contamination of groundnuts by aflatoxin itself have both been considerably reduced in this country in the past few years as a result of action taken in the light of the findings in the report. A voluntary code of practice has recently been agreed with industry to reduce the aflatoxin B_1 contamination in nuts and nut products; monitoring of these foods is continuing. The Working Party on Mycotoxins, which was formed in 1975, was re-formed in 1983 as a Sub-Group of the new Working Party on Naturally Occurring Toxicants in Food. Work on mycotoxins will now concentrate on toxic metabolites of the mould *Fusarium*. These compounds have been found in some samples of grain in this country and overseas[28]. Further survey work and in particular toxicological research on one of these compounds, deoxynivalenol, will be carried out to determine whether any toxic hazard is posed to the consumer by this compound in food.

Working Party on Nutrients

45. In recent years, the nutrient composition of the UK food supply has been kept under surveillance by the Committee on the Composition of Food and Food Products, whose terms of reference were 'to identify areas in which information on the nutrient content of food is insufficient for monitoring the national diet adequately, to assess priorities and to arrange for that information to be obtained'. In practice, much of its work has been carried out through its Sub-Group on Food Composition Tables, but both groups have now been combined into a Working Party on Nutrients.

46. Although information on the nutritional value of foods already exists in *The Composition of Foods* (Paul and Southgate, 1978) for which the earlier Committee was responsible, it requires updating and extending for three important reasons. First, foods themselves are changing as new farming and food processing methods affect traditional foods and as new foods come on to the UK market; second, analytical methods are improving and demonstrate that some earlier estimates of nutrient content are misleading; and third, little information is given on the ranges of nutrient content that can be found in individual foods or on the factors that may influence nutritional value. All these factors are being addressed, in some instances after basic research has been commissioned. Recent examples include studies of a wide range of nutrients in meat products, cereal products, dairy products and ethnic foods, and on the different forms of vitamin A and folic acid in selected foods. Further work planned includes the analysis of seasonal variation in the nutrient content of new cultivars of vegetables and vegetables from countries that did not previously export to the UK, and of the different biologically-active forms of selected trace minerals in foods. The results of the work are published in the scientific literature [29, 30, 31] and will be brought together in supplements to *The Composition of Foods*. The first two supplements will cover cereal products and foods consumed by immigrants.

Such information is used in updating the Ministry's statistical series evaluating household diets (the National Food Survey) and the nation's food supplies (Consumption Levels Estimates). It has also been used in assessing the nutritional consequences of various possible emergency situations and by the Department of Health and Social Security's Committee on Medical Aspects of Food Policy. The most recent examples of the latter are in assessing the need for the continued fortification of flour, for comparing nutrient intake and susceptibility to coronary heart disease and for assessing the nutritional impact of changes in regulations on school meals.

Working Party on Pesticide Residues

47. Each year, extra food is required to meet the need of an expanding world population. It has been estimated that throughout the world some 30–50 per cent of crops are lost to pest damage even before harvest. Without the use of pesticides a further 30 per cent would be lost[32]. To be effective pesticides must be toxic to the target species and, although they are usually selectively less toxic to higher animals and man, it is necessary to ensure that crops treated with pesticides are safe for human consumption. Pesticides must undergo an extensive safety evaluation by the Advisory Committee on Pesticides (ACP) before clearance is given for their use. This clearance includes a consideration of risks arising from the consumption of food containing pesticides at the levels expected to arise in practice. In order to ensure that, once in use, residues are not higher than had been expected and to check on residues in imported food, various bodies have been organising work for the ACP for the past 20 years. In 1977 the ACP and the Steering Group agreed that their interests would be best served by having a joint Working Party on Pesticide Residues. The background to its formation and a detailed description of some of its activities have recently been published[33]. The Working Party utilises periodic total diet studies and specific surveys in its programme of surveillance. Large-scale surveys of the major food commodities, namely cereals, fruit, vegetables and animal products (including milk and dairy products) are undertaken at regular intervals. Residues in human breast milk and fat are also determined at regular intervals. At present further survey work is being undertaken on residues of insecticides and fumigants in stored cereal grains because more cereals are being stored now than was the case a few years ago. A three year survey of residues of pesticides on fruit and vegetables was begun in 1981. Both imported and UK products were examined as were samples from 'pick-your-own' outlets. Post-harvest fungicide treatments of fruit and vegetables in store are being investigated in further detail following the preliminary work described in the Working Party's report[32]. Some areas which have been of particular interest are highlighted in the following sections.

Dieldrin

48. Dieldrin is an organochlorine insecticide which due to its effectiveness was widely used until about 20 years ago when international concern arose about the environmental effects of persistent organochlorine pesticides. In 1964 the use and effects of dieldrin were reviewed by the Advisory Committee on Pesticides and, as a result, its use in agriculture was restricted. At the same time it was recommended that monitoring of dieldrin levels, in food, human tissues and the environment, should continue. Subsequently the restrictions on the use of dieldrin have been steadily increased. A review of the incidence and levels of residues found in food since 1965 has been published by the Working Party[34].

This report concludes that the average human exposure to dieldrin in the UK through the consumption of food had decreased over the past 10 years and more recent dietary studies show that this trend is continuing (Figure 6). The reduction is almost certainly due to the fact that there are now no products containing dieldrin which are cleared for agricultural use in the UK. Dieldrin can still be used as a wood preservative which, through environmental persistence, has led to occasional residues in food but a strict code of practice has now been agreed with the Wood Preservers Association to avoid such incidents in future.

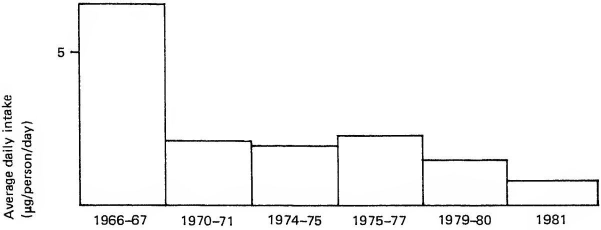


Fig. 6 Daily dietary intake of dieldrin calculated from total diet studies.

Hexachlorocyclohexane (HCH)

49. Like dieldrin, HCH is an organochlorine pesticide. It can exist in eight geometrically different chemical forms (isomers) but insecticidal activity is largely restricted to one isomer, γ-HCH, which is less persistent in the environment compared with some of the other isomers. 'Technical HCH' is a mixture of isomers (although only four are usually present in significant quantities). The use of technical HCH has been gradually phased out in the UK in favour of preparations containing more than 99·0 per cent of γ-HCH, (commonly referred to as 'lindane') and since 1981, the use of technical HCH has been prohibited throughout the European Community. The use of γ-HCH is widespread and because of its effectiveness and cheapness, its use is increasing in the UK by about 10 per cent per annum. Partly as a result of this and partly because some foreign countries continue to use technical HCH, which may give rise to unacceptable residues in imported foodstuffs, residues of HCH have been monitored in food and human tissues. The data collected since the 1960s have been published in a Working Party Report[35] and indicate that the average dietary exposure to HCH is now low, having decreased substantially over the last 15 years. Residues of isomers other than γ-HCH have decreased, reflecting the change in agricultural practice (Figure 7). Residue levels continue to be monitored.

Polychlorinated biphenyls (PCBs)

50. Polychlorinated biphenyls (PCBs) are a mixture of organochlorine chemicals with closely related structures which have had a number of industrial uses since the 1930s when they were first manufactured. Their particular physical

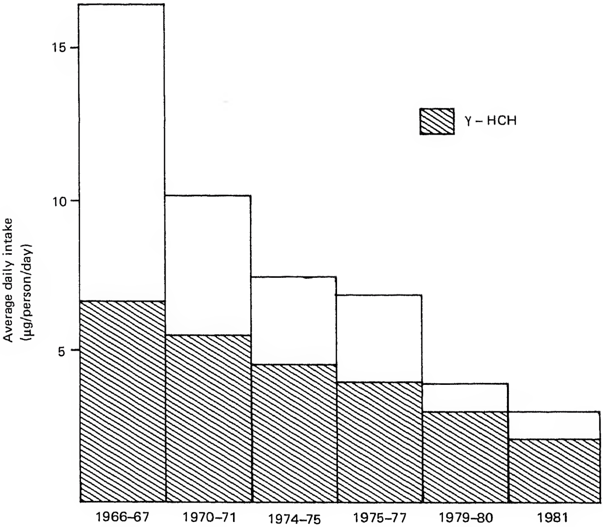


Fig. 7 Daily dietary intake of HCH calculated from total diet studies.

and chemical properties make them environmentally persistent, and it was discovered in the late 1960s to early 1970s that they were accumulating in the food chain. Action was then taken in the UK and other countries to restrict their use initially voluntarily and then by law. Since 1977 none have been produced in either the UK or the USA. Their properties make them amenable to analysis with the methods used in determine residues of persistent organochlorine pesticides such as dieldrin and HCH. Responsibility for surveillance of PCB residues was therefore included within the programme of the Working Party on Pesticide Residues.

51. At the request of the Steering Group, a programme of monitoring for PCB levels in food and human tissues was instigated. The results of this work and a review of other measurements have been published in a report[36]. The dietary studies undertaken show that human exposure in the UK to PCBs through food consumption is low. Fish is the only food group which consistently contains PCB residues albeit at levels which are much lower than have been reported as being present in fish consumed in other parts of the world. At the request of the COT, periodic monitoring, particularly of breast milk and fish, will continue since equipment containing PCBs is still in use and will eventually be disposed of; this disposal may result in low-level discharges of PCBs to the environment.

Working Party on Food Colours

52. In its Interim Report on the Review of the Colouring Matter in Food Regulations published in 1979, the FACC recommended that there should be stricter controls on the use of added colouring matter in food. The FACC was unable to recommend how extensive such controls should be and what form they should take without more detailed information on the current levels of added colouring matter. In order to provide this information, a Working Party was set up in 1979 under the Steering Group on Food Surveillance.

53. Unlike other surveys so far conducted by the Steering Group, the survey was not carried out by chemical analysis of food. The information was obtained by requesting food manufacturers, through their trade associations, to declare on a survey form the quantities of coloured ingredients they were adding to defined food products. In order to maintain commercial confidentiality, the suppliers of those coloured ingredients were asked to provide information on the content of permitted colouring matters in each named ingredient.

54. The survey was carried out in 1980 and yielded almost five and a half thousand usable returns covering a range of foods. When all the subsidiary enquiries had been made to the colour suppliers, the data were collated by computer. The Working Party's Report, together with the data, were submitted to the FACC for consideration in July 1983. As the data were generated with the specific aim of assisting the FACC, the data were presented to facilitate an appreciation of how technological colouring effects are achieved in different foods. Evaluation of the data by the FAC is continuing and will be published in a report. The Report of the Working Party together with a summary of the data on colour usage will also be published. This exercise has provided valuable information. The success of this initial exercise suggests that it can be used as a model for future investigations of the concentrations of additives in food and it demonstrated once again the value of co-operation with industry.

Working Party on Nitrates and Related Compounds

55. Nitrate is present in nearly all foods as a result of the natural uptake of nitrate from soil, its presence in the water supply, and its use as a food additive in cured meats and some cheeses. It is itself essentially non-toxic to man. Nitrate can be reduced to nitrite under certain circumstances in food and in the body. Nitrite can cause toxic effects, particularly in infants, but it is the importance of nitrite as a precursor of N-nitroso compounds (chemical compounds containing the N-NO group) that has focussed attention on its presence in food (see Figure 8). Many N-nitroso compounds have been shown to induce tumours in a large number of animal species. For these reasons the topic has been the subject of active research since the 1960s. Much of this work has been undertaken in those Government laboratories which have responsibilities for investigating potentially adverse effects of chemical pollutants in food and the environment.

56. In its report on *Agriculture and Pollution*[37] the Royal Commission on Environmental Pollution considered that better information was needed on the nitrate content of foodstuffs as consumed, and they accordingly recommended that a study be undertaken. The work carried out so far in response to this request indicates that at present the average dietary intake of nitrate and nitrite in the UK

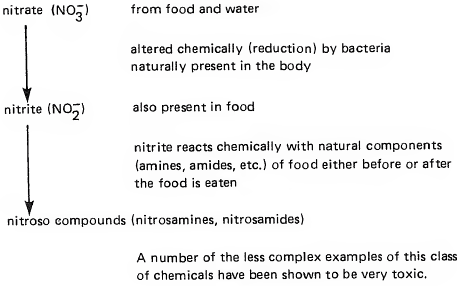

nitrate (NO_3^-)
from food and water
altered chemically (reduction) by bacteria naturally present in the body
nitrite (NO_2^-)
also present in food
nitrite reacts chemically with natural components (amines, amides, etc.) of food either before or after the food is eaten
nitroso compounds (nitrosamines, nitrosamides)
A number of the less complex examples of this class of chemicals have been shown to be very toxic.

Fig. 8 The formation of nitroso compounds in food and man.

is about 60 mg per person per day and less than 1 mg per person per day respectively. This is similar to the intakes which have been found in other European countries[38,39,40,41]. Vegetables are the major source of these compounds in the average diet. The Working Party is also giving careful consideration to the Royal Society's report on the nitrogen cycle in the UK[42].

57. In addition to the work on nitrate and nitrite, work has been undertaken on the occurrence in food of volatile N-nitrosamines. The principal foods where volatile N-nitrosamines have been detected are cured meats and fish and some malt-derived beverages. The discovery in 1978 of traces of N-nitrosodimethylamine (NDMA) in beer led to a detailed programme of surveillance being undertaken in the UK. Levels of NDMA were found but were generally low (mean 2 μg/kg). Because of the amount of beer which is drunk and the fact that NDMA is carcinogenic at low doses in the rat, the topic was investigated in detail by MAFF Food Science Laboratory in collaboration with the malting, brewing and distilling industries.

58. The source of NDMA in beer was found to be malt, in which the higher levels were generally found to be associated with direct gas-fired kilns. During malt production the germinated barley is dried and heated to a moderately high temperature. In common with many other countries the UK direct-fired kilning process is based on blowing combustion gas diluted with air through the germinated barley for 24–28 hours. In 1970 natural gas became generally available, was favourable in cost and, because of its low sulphur content, reduced pollution and corrosion compared with other fuels. The presence of sulphur dioxide in the combustion products from traditional fuels was found to inhibit NDMA formation which is postulated to occur primarily through a reaction of 'nitrogen oxides' in the combustion gas with an amine, hordenine, naturally present in 'green' malt. Extensive research on ways in which this adverse reaction might be inhibited were undertaken involving design changes to the burners and the controlled addition of sulphur dioxide. These changes, particularly the latter, have been introduced and NDMA levels in beer are now significantly lower than were found in the 1970s.

59. A reduction in the potential for nitrosamine formation in cured meat products has been sought by the FACC who, on the basis of extensive surveillance and experimental data, reviewed the Preservatives in Food Regulations (1979). They recommended lowering[43] the maximum permitted levels of sodium nitrate and nitrite in a range of cured meat products and these were given statutory force in 1982[44]. In 1983 the Steering Group on Food Surveillance considered the question of the occurrence of these and related compounds in food and recommended that a Working Party on Nitrates and Related Compounds be formed to oversee work in this field.

MONITORING OF FOOD FOR RADIONUCLIDES

60. The Steering Group on Food Surveillance is not directly responsible for monitoring of food for contamination by radionuclides. This is, however, an important aspect of MAFF's scientific and regulatory work. Surveys of radionuclides are carried out by the Fisheries Radiological Laboratory at Lowestoft and by the Atomic Energy Unit in MAFF's Food Science Division. Relevant research is also commissioned with outside bodies, including the National Radiological Protection Board, and the results of the monitoring and research work are published in Ministry publications (for example reference 45) and in the scientific literature (for example reference 46). The role of the Steering Group on Food Surveillance in this area is currently being considered.

INPUT INTO OTHER ORGANISATIONS

61. The Steering Group and its Working Parties generate information which is of relevance to the chemical composition of food. The information is published both in the scientific literature and in the form of reports so that those interested in the information may have access to it. The use to which the information is put extends far beyond a simple informing role.

62. Expert Committees such as the FAC advise Ministers on the need for new legislation or changes in existing legislation on chemicals in food. The information produced by the Steering Group and the Working Parties is used by these Committees in performing their advisory functions. In the furtherance of trade harmonisation the European Community (EC) is producing a series of directives about chemicals in food, especially food additives and monomers in plastic packaging. It is important that UK representatives who attend EC meetings to discuss proposed legislation are supplied with relevant scientific information and the opinion of the Advisory Committees with which to sustain a UK view. Other members of the EC are unlikely to be moved unless our representatives' arguments are backed by hard facts and informed advice.

63. The World Health Organisation, the Food and Agriculture Organisation (FAO) and the Council of Europe also consider the subject of chemicals in food. These bodies make recommendations about the composition of food and maximum and minimum intakes of chemicals. These recommendations do not have the force of law but are often used by countries as a guide to what is acceptable. Sometimes the recommendations are incorporated into national legislation, particularly in countries which do not have the resources to develop their own standards. Information generated by the surveillance programme is

regularly supplied to these international organisations. This information helps to provide a firm basis for decisions which may improve food quality, lead to new food standards, changes in recommendations on intakes of chemicals, and facilitate international trade. Laboratories which generate information for the surveillance programme also play a more direct role in the work of international bodies, such as the FAO, for example by organising or participating in studies made to assess and, where necessary, improve the accuracy of various food analyses. In addition, individual scientists contributing to the surveillance programme are sometimes invited by the international organisations to play an active role in assisting them in their work, for example by providing advice at meetings, by making a secretarial input or by contributing to publications (for example reference 47).

CONCLUSION AND PROSPECT

64. Since the publication of its first report, many of the initial investigations undertaken by the Steering Group on Food Surveillance have been completed. In the light of experience the structures of both the Steering Group and its Working Parties have been reviewed. The former has been reconstituted into a small but widely representative executive group better able to give guidance on priorities and to recommend any action warranted by the results of surveys. Several Working Parties have been amalgamated and given broader and clearer terms of reference. Their membership has also been adjusted to assemble the widest possible spectrum of expertise and to increase the access to both public and industrial laboratory facilities capable of participating in the surveillance programme.

65. As a result of these developments the framework within which the Steering Group operates and its objectives and methods are now more clearly defined and its central role in the collection of representative data upon which hazard assessments can be based is firmly recognised. In the past action has been taken to reduce obvious food contamination when this has been uncovered by the surveillance programme; examples include action to reduce the level of lead in canned baby foods[8], action to reduce the levels of mercury in fish taken from certain UK waters[48], and action to reduce the level of vinylchloride monomer in foodstuffs (see para. 35). Similar action will, no doubt, be taken from time to time in the future as the situation requires it. Most surveys show that remedial or corrective action is not required but from time to time unexpected results are thrown up by the surveillance programme. These odd results include, for example, results which appear to be abnormally high or significantly diverge from what is generally accepted as normal. The Steering Group is currently considering how to deal with these aberrant results. The delegation of planning to Working Parties has led to the more systematic use in food surveys of recently developed and sensitive analytical methods, collaboratively tested where possible to ensure the reliability of the results. Sampling schemes have received the attention necessary to produce representative data without either overwhelming the available analytical resources, or concentrating too heavily on only one part of the diet. In many instances research work has been commissioned in support of the surveillance programme. This has concentrated particularly on improving the analytical methods used in food surveys, elucidating the pathways by which chemicals enter the food chain and understanding their significance to the consumer. By all these means the Steering

Group has provided reliable information upon which advice to Ministers can be based. Furthermore, the Steering Group is keeping under review the allocation of resources to its work and the balance of emphasis between different surveillance programmes. As new problems arise and old ones are solved priorities change.

66. Several parts of the food surveillance programme have been particularly innovative and rewarding during the recent past. Investigations of certain monomer levels in food packaging materials and their propensity to migrate into food have been the first systematic work in this field and by involving the industry closely, have in themselves led to significant lowering of the level of some of these materials in food packaging and packaged foods. Following the demonstration of the occurrence of nitrosamines in malt products, close co-operation with the industry led to the unravelling of the cause of their occurrence and to their subsequent reduction and the elimination of any potential hazard by changes in the technology involved. The recent survey of the levels and extent of use of permitted colours in foods also involved extensive input from industry and has provided valuable experience should further surveys of permitted additives prove necessary.

67. The Working Party on Pesticide Residues has steadily widened its programme which covers processed foods as well as raw agricultural commodities. The regular and long-standing Total Diet Study and Human Fat and Human Milk surveys are augmented by cyclical surveys of the major sectors of the diet; such as fruits and vegetables, cereal products, meat products and dairy products. The results, which now include analyses for a greater range of residues than previously, continue to provide reassurance. The residues in the great majority of home-grown and imported foods are either below the limit of detection or well below the maximum levels internationally accepted as presenting no hazard to the consumer.

68. The more recently constituted Working Party on Veterinary Residues in Animal Products has succeeded in establishing a National Meat Monitoring Programme based on a statistically drawn random sample at the slaughterhouses. This has not only proved valuable for surveys of drug residues but will provide representative samples of meat for future investigations by other Working Parties. This Working Party has stimulated the development of new or improved analytical methods for the detection of a range of drug residues in a variety of animal tissues and fluids.

69. The extent of occurrence and significance of mycotoxins in the United Kingdom diet has also provided a stimulating challenge. The results from the programme of the Working Party on Naturally Occurring Toxicants in Food continue to demonstration the difficulties of assembling a reliable picture of the problem. However, its published *Survey on mycotoxins in the United Kingdom* (Food surveillance paper No. 4, HMSO) highlighted the occurrence of significant levels of aflatoxin in groundnut meal and hence in milk from animals given contaminated groundnut in their feed. Subsequent changes in the Fertiliser and Feedingstuffs Regulations have effectively eliminated this contamination from milk in the United Kingdom. An agreement has recently been reached with the major importers on improved quality control procedures. The effect that this has on the levels of aflatoxin in groundnut and other nuts destined for human consumption is currently being monitored.

70. Environmental contamination by heavy metals, particularly lead, has provoked extensive public discussion during the period under review. Earlier work on the levels of mercury, lead and cadmium in the food supply commissioned in anticipation of the current debate by the Steering Group provided useful base-line data with which to answer questions posed. The Working Party on Heavy Metals has meanwhile directed its attention to studies seeking to elucidate the relationships between metal residues in food and in the environment in which it is produced, and studies aimed at estimating the proportion of the heavy metal ingested which is absorbed from the gut. The absorption of metals from the gut has been shown to be dependent not only on the particular food containing the metal, but also on accompanying food and the meal patterns of the individual.

71. Many areas remain to be investigated and the Steering Group must decide on the priorities to be assigned to them within the resources available. Various factors influence its decisions. The continuing interest of the European Community in food packaging materials dictates that in addition to monomers the occurrence and migration of a wide variety of chemical additives in food packaging requires attention. Multi-residue analytical methods may need to be developed to investigate this problem. The action taken by Government to reduce lead in petrol, as well as other initiatives to lower lead levels in various commodities and the move away from the lead-soldered can, all require further food surveillance to monitor their effectiveness in lowering food-borne lead. The use of nitrogenous fertilisers in agriculture and nitrate and nitrite in food processing to maintain the availability, variety and safety of food, will continue and a check must be maintained on the identity and the extent of the intake of nitrogen compounds derived from these sources and the pathways by which they are incorporated into food. The recently reconstituted Working Party on Nitrates and Related Compounds in Food will keep this area under review.

72. Economic and technical developments, many stimulated by the Common Agricultural Policy, have led to changes in farming practice and to increased production and storage of food within the EC. Work on pesticide residues is currently aimed to ensure that such changes, which could not have been foreseen when most pesticides were originally cleared for use, do not lead to unacceptable residues in either home-produced or imported food. Rapid changes have also occurred in the nature and manner of use of veterinary drugs. Whilst the present surveillance system is capable of detecting any resulting residues in meat, the Steering Group has recognised the need for the initiation of a National Poultry Monitoring Scheme, especially in view of the importance of poultry in the national diet. Modern farming methods and the introduction of new varieties of plants and new breeds of animals, a trend likely to be accelerated as biotechnology advances, also influence the priorities of the Working Party on Nutrients, which is required to demonstrate whether such changes are affecting the nutrient intake.

73. Research world-wide often uncovers the presence of unexpected chemicals in food. In some instances, it is difficult to determine, in the absence of historical samples, whether such chemicals have always been present or whether they are the result of recent changes in farming practice or of environmental conditions. Mycotoxins are a case in point and the recent demonstration of the presence of vomitoxin, a *Fusarium* toxin in cereals is an example. The present international

effort to estimate the extent of its occurrence, to understand its significance and to predict the conditions leading to its formation is strongly supported by the Steering Group. Industrial processes have also been shown to give rise on occasions either to widespread or point source contamination of food. The presence of polychlorinated biphenyl (PCB) residues at low levels in certain foods is a well-known example of the former. The formation of small amounts of various chlorinated dioxins as contaminants in certain industrial operations which has recently been demonstrated is an example of the latter and its likely impact on food is being given attention by the Steering Group. However, the advanced analytical methodology required to measure the extremely low concentrations of dioxins and the sampling scheme required to deal with the likely heterogeneity of the distribution make this a particularly difficult problem.

74. The data upon which to make priority decisions and to design food surveillance programmes are often sparse. The identity of many substances in food is unknown and the extent of the occurrence of chemically identified substances is still uncertain. Even when their identity and extent of occurrence are known their long-term significance for human health is often not well understood. These uncertainties are perhaps greatest when considering the non-nutritive chemicals which are natural components of most foods, and the priorities to be assigned to surveillance in this area are particularly difficult to ascertain. Nevertheless the potentially adverse effects of erucic acid and glucosinolates in food and feed derived from rapeseed are well established and these two natural substances have received detailed study leading to the development of new varieties of rape, containing low concentrations of these components. Other natural components may also be of significance in the long term in human health; a problem which may be unrecognised, even though the particular foods concerned have been consumed for many generations. This can be accentuated if the breeding of new plant varieties alters their chemical composition. To date, the Steering Group has been unable to assign priorities to this area but is actively considering approaches which may allow it to do so.

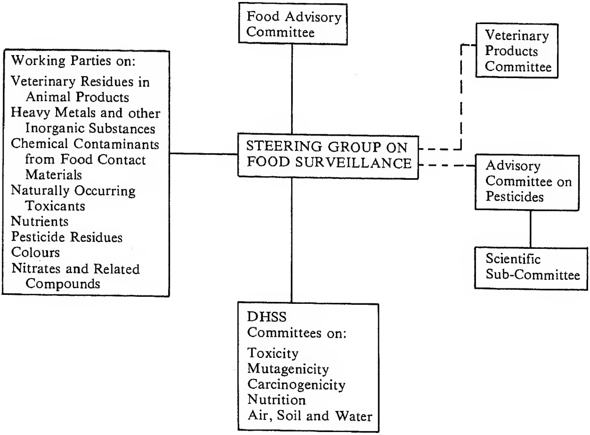
75. Whilst most of the present priorities refer to particular areas covered by the various Working Parties, the Steering Group has identified two additional priorities which cover the whole of food surveillance. The first is the continued development of accurate sensitive, selective and reproducible analytical methods to improve the reliability of the data on the dietary intake of chemicals. The second is the publication of data in an appropriate form at the earliest convenient opportunity.

76. Future developments requiring the attention of the Steering Group are very difficult to predict. Although about two-thirds of our food is home produced, the Steering Group intends to continue to encourage the monitoring of imported foods, in particular the many exotic foods which are now available. Furthermore, studies on people having atypical dietary habits, such as vegetarians and some ethnic groups will also continue in addition to studies on 'average consumers'. Changes in agriculture, food processing technology and the environment will continue to give rise to occasional unforeseen chemical contamination of food and other industrial technological changes may do likewise. Furthermore, if unforeseen residues find their way into food, interaction with other food components and changes brought about by metabolic action in the body increase the uncertainty in deciding whether such

chemical contamination is significant. The Steering Group and its Working parties endeavour to remain alert to such possibilities to protect the consumer. As the predictive power of toxicology improves it may become possible to foresee some of these developments but it is unlikely that this will be possible in all cases and the Steering Group must remain able to react rapidly to any new contaminant to provide reliable information upon which Government can take action if necessary. The Steering Group intends to consider the relevance of standards or guideline limits for chemicals in food in relation to the surveillance programme. In most surveillance work the co-operation of the industry is paramount. It has been given up to the present and has helped effective food safety measures to be taken. The government believe that this survey of the work carried out over the last six years demonstrates the effectiveness of the present food surveillance programme and see no reason to doubt that it will continue to be a valuable safeguard to the public against any possible risk to health in our diet.

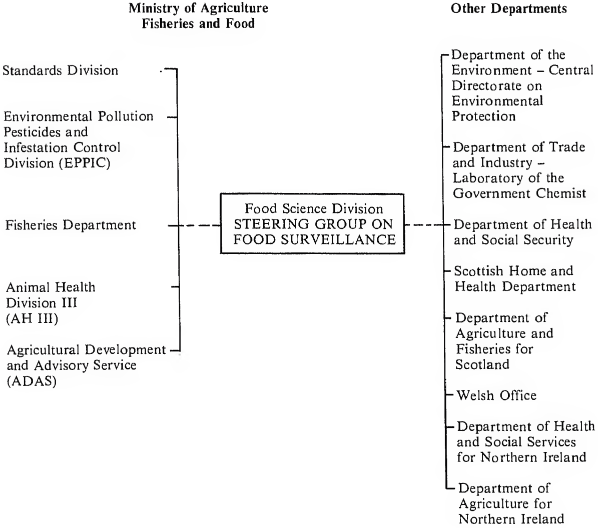
APPENDIX I

COMMITTEE STRUCTURE OF THE STEERING GROUP AND ITS RELATION TO OTHER COMMITTEES


Food Advisory Committee
Working Parties on:
Veterinary Residues in Animal Products
Heavy Metals and other Inorganic Substances
Chemical Contaminants from Food Contact Materials
Naturally Occurring Toxicants
Nutrients
Pesticide Residues
Colours
Nitrates and Related Compounds
STEERING GROUP ON FOOD SURVEILLANCE
Veterinary Products Committee
Advisory Committee on Pesticides
Scientific Sub-Committee
DHSS Committees on:
Toxicity
Mutagenicity
Carcinogenicity
Nutrition
Air, Soil and Water

APPENDIX II

DIVISIONS WITHIN MAFF AND GOVERNMENT DEPARTMENTS INVOLVED IN FOOD SURVEILLANCE


Ministry of Agriculture Fisheries and Food
Other Departments
Standards Division
Environmental Pollution Pesticides and Infestation Control Division (EPPIC)
Fisheries Department
Animal Health Division III (AH III)
Agricultural Development and Advisory Service (ADAS)
Food Science Division STEERING GROUP ON FOOD SURVEILLANCE
Department of the Environment – Central Directorate on Environmental Protection
Department of Trade and Industry – Laboratory of the Government Chemist
Department of Health and Social Security
Scottish Home and Health Department
Department of Agriculture and Fisheries for Scotland
Welsh Office
Department of Health and Social Services for Northern Ireland
Department of Agriculture for Northern Ireland

Divisional Responsibilities within MAFF include:

Food Science Division – generation, collection and interpretation of data on chemical residues in food and the provision of scientific advice on legislation.

Standards Division – administration of the Food and Drugs Act with particular regard to additives. contaminants, composition and labelling.

EPPIC – general co-ordination within MAFF of environmental pollution matters nationally and internationally.

Fisheries Divisions – protection of the marine environment and prevention of hazards to man via the consumption of fish.

AHIII – (as the licensing authority for veterinary medicines) in consultation with the medicines unit, Central Veterinary Laboratory and with the advice of the Veterinary Products Committee as necessary, assesses data on residues as part of the licensing process for veterinary medicinal products to be used in food animals.

ADAS – advice and data on agricultural residues in crops and animals.

FOOD SURVEILLANCE REPORTS

The following reports, all published by HMSO, have previously appeared in the Food Surveillance series:

Food Surveillance Paper Number	Title	Date
1	*The surveillance of food contamination in the United Kingdom*	1978
2	*The survey of the vinyl chloride content of polyvinyl chloride for food contact and of foods*	1978
3	*The survey of the vinylidene chloride levels in food contact materials and in foods*	1980
4	*Survey of mycotoxins in the United Kingdom*	1980
5	*Survey of copper and zinc in food*	1981
6	*Survey of acrylonitrile and methacrylonitrile in food contact materials and in foods*	1982
7	*Survey of dieldrin residues in food*	1982
8	*Survey of arsenic in food*	1982
9	*Report of the Working Party on Pesticide Residues (1977–1981)*	1982
10	*Survey of lead in food: Second Supplementary Report*	1983
11	*Survey of styrene levels in food contact materials and in food*	1983
12	*Survey of cadmium in food: First Supplementary Report*	1983
13	*Polychlorinated biphenyl (PCB) residues in food and human tissues*	1983

APPENDIX IV

FUNCTION OF THE INDEPENDENT EXPERT ADVISORY COMMITTEES

Food Advisory Committee (inaugural meeting held in November 1983)

The Food Advisory Committee, an independent body of experts, advises the Minister of Agriculture, Fisheries and Food, the Secretary of State for Social Services, the Secretary of State for Wales, the Secretary of State for Scotland and the Head of the Department of Health and Social Services for Northern Ireland on matters referred to it by Ministers relating to:

(i) the composition, labelling and advertising of food;

(ii) additives, contaminants and other substances which are, or may be, present in food or used in its preparation;

with particular reference to the exercise of powers conferred on Ministers by Sections 4, 5 and 7 of the Food and Drugs Act 1955 and the corresponding provisions in enactments relating to Scotland and Northern Ireland.

Food Additives and Contaminants Committee (ceased operation in October 1983 following its merger with the Food Standards Committee to form the Food Advisory Committee)

1. The Food Additives and Contaminants Committee, an independent body of experts, advises the Minister of Agriculture, Fisheries and Food, the Secretary of State for Social Services, the Secretary of State for Wales, the Secretary of State for Scotland and, as respects Northern Ireland, the Head of the Department of Health and Social Services, on matters referred to them by Ministers in relation to food contaminants, additives and similar substances which are, or may be, present in food or used in its preparation, with particular reference to the exercise of powers conferred on Ministers by sections 4, 5 and 7 of the Food and Drugs Act 1955 as amended and the corresponding provisions in enactment relating to Scotland and Northern Ireland.

Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment

2. The Committee on Toxicity advises at the request of Government Departments, on the toxic risk to man of chemicals in food, consumer products and the environment.

WORKING PARTIES REPORTING TO THE STEERING GROUP

(a) Veterinary Residues in Animal Products
(b) Heavy Metals and other Inorganic Substances
(c) Chemical Contaminants from Food – Contact Materials
(d) Naturally Occurring Toxicants in Food
(e) Nutrients
(f) Pesticide Residues
(g) Colours
(h) Nitrates and Related Compounds

VETERINARY RESIDUES IN ANIMAL PRODUCTS

Chairman Mr T J Coomes BSc, FIFST
Secretariat Dr D G Lindsay BSc, PhD
Dr D H Watson BSc, PhD, MIBiol

Terms of Reference

(a) To collect data and report on the incidence and levels of residues of certain growth promoters and certain therapeutic substances in home-produced and imported meat and meat products;

(b) To consider the need for further analytical surveys and advise the Steering Group on Food Surveillance on such organisation as is required;

(c) To set up panels as and when necessary to consider and advise on, for example, analytical methods and sampling;

(d) To liaise with existing bodies such as the Veterinary Products Committee (VPC) and the Scientific Sub-Committee of the VPC; and

(e) To report at intervals to the Steering Group on Ford Surveillance and to publish the results of surveys and monitoring activities in such form as is appropriate.

HEAVY METALS AND OTHER INORGANIC SUBSTANCES

Chairman	Dr P J Bunyan BSc, PhD, DSc, CChem, FRSC
Secretariat	Dr J C Sherlock BSc, PhD, CChem, FRSC, MICorrT Miss G A Smart MSc, MIInfSc

Terms of Reference

To determine the amounts of certain heavy metals and other inorganic substances in food in the United Kingdom and to make reports. The results of the surveys to be submitted to the COT and the FAC who would inform the Ministers if any hazard to health existed.

CHEMICAL CONTAMINANTS FROM FOOD - CONTACT MATERIALS

Chairman Mr T J Coomes BSc, FIFST
Secretariat Dr J D McGuinness BSc, PhD, CChem, MRSC

Terms of Reference

(a) To keep under review the possibility of contamination of any part of the UK food supply by chemicals arising from food contact materials and articles;

(b) Where such a possibility appears to be significant, to determine the amounts of such chemicals in food contact materials and/or in food and to report these findings to the Steering Group on Food Surveillance;

(c) To identify specific areas of chemical contamination by food contact materials and undertake investigations into these, through the establishment of sub-groups should this be considered necessary; and

(d) To publish, where appropriate, the results of work in the form of Food Surveillance Papers after due consultation with those bodies defined as relevant by the Steering Group on Food Surveillance.

NATURALLY OCCURRING TOXICANTS IN FOOD

Chairman	Mr T J Coomes BSc, FIFST
Secretariat	Dr D G Lindsay BSc, PhD Dr D H Watson BSc, PhD, MIBiol

Terms of Reference

(a) To consider the need for analytical surveys of food for chemical toxins of natural origin (including mycotoxins and bacterial toxins, the latter where these are pre-formed in food and for which chemical methods of analysis are appropriate);

(b) To undertake analytical surveys of retail food products or of the materials used in their production with a view to establishing the likely exposure of the United Kingdom population – or groups at special risk – to the toxic substance;

(c) To develop suitably sensitive and reproducible detection methods where this is necessary to meet the needs defined in paragraph (b);

(d) To investigate as far as practicably possible effective scientific and technological methods of reducing human exposure in the United Kingdom to such hazard where this is judged prudent or necessary; and

(e) To report at intervals to the Steering Group on Food Surveillance and to publish the results of work in the form of Food Surveillance Papers after due consultation with those bodies defined as relevant by the Steering Group on Food Surveillance.

NUTRIENTS

Chairman Dr J R Park BSc, PhD, FIFST
Secretariat Dr D H Buss BSc, PhD, FIFST

Terms of Reference

(a) To identify areas in which information on the content and availability of nutrients in food is required to ensure that the nation's food supplies and diets can be adequately monitored; to review programmes for maintaining McCance and Widdowson's *The Composition of Foods* and the Ministry's nutrient data bank; to assess priorities; and to propose means of obtaining the information;

(b) To propose or, when requested, advise on the planning of dietary surveys for the Steering Group on Food Surveillance to determine normal and extreme intakes of dietary constituents in groups of the population; and to oversee the Total Diet Study; and

(c) To advise other committees and Departments as appropriate.

PESTICIDE RESIDUES

(this Working Party also reports to the Advisory Committee on Pesticides)

Chairman Dr P J Bunyan BSc, PhD, DSc, CChem, FRSC
Secretariat Mr J W Edmunds LRIC
Dr D G Lindsay BSc, PhD
Dr D H Watson BSc, PhD, MIBiol
Miss S M Hones BSc
Mr E Thompson

Terms of Reference

In consultation with the appropriate bodies:

(a) to propose selective surveys to determine the residues of pesticides and/or their toxic derivatives in raw and processed foods and animal feeds from indigenous and foreign sources where pesticides have been applied in commercial practice or during supervised trials;

(b) to propose, arrange and direct studies of pesticide residues and/or their toxic derivatives in the total diet or in particular foodstuffs;

(c) to propose, arrange and direct surveys to determine the levels of pesticides and/or their toxic derivatives in human tissue, wildlife or in other aspects of the environment where appropriate to the consideration of the safety in use of particular pesticides; and

(d) to report to those bodies the results of such surveys or studies with recommendations.

To co-ordinate sampling activities and appropriate analytical work of those laboratories agreeing to undertake the surveys recommended under (a), (b), and (c) above.

To draw the attention of the MAFF Committee for Analytical Methods for Residues of Pesticides and Veterinary Products in Foodstuffs (CAM) to any particular need for new or improved analytical methods.

To keep under review information relating to the levels of the active ingredients of pesticides and their metabolites of toxicological significance to man, domestic animal and the environment. To co-ordinate and with the agreement of the parent bodies to disseminate such information as appropriate.

To review and consider relevant residues data for particular pesticides when requested by the PSPS or Government Departments.

To review and consider relevant residue data on pesticides and/or their toxic derivatives for submission by the UK to international bodies such as the Codex Alimentarius Commission, FAO, EC and the Council of Europe.

COLOURS

Chairman Mr T J Coomes BSc, FIFST
Secretariat Dr W H B Denner BSc, PhD

Terms of Reference

(a) To obtain detailed information on the levels of use of permitted colouring matters currently used in individual foods;

(b) To present the usage data in an appropriate manner to demonstrate:

  (i) the range of levels at which each colouring matter is used in each food;

  (ii) the range of levels of total colouring matter used in each food.

(c) To draw attention to any potential problems in the interpretation of the data for legislative purposes;

(d) To submit a report to the Steering Group on Food Surveillance.

NITRATES AND RELATED COMPOUNDS

Chairman Dr M E Knowles B Pharm, PhD, CChem, FRSC, FIFST
Secretariat Dr D G Lindsay BSc, PhD

Terms of Reference

(a) To consider the need for analytical surveys of food for nitrate, nitrite, nitrosamines and related compounds;

(b) To undertake analytical surveys of foods or of the materials used in their production with a view to establishing the incidence, frequency and levels of these contaminants in the food chain in the United Kingdom. Priorities for the various aspects of this work will be carefully assessed;

(c) To develop suitably sensitive and reproducible detection methods where this is necessary to meet the needs defined in paragraph (b);

(d) To investigate, as far as practicable, possible scientific and technological methods of assessing human exposure and reducing this exposure where this is judged necessary;

(e) To report at intervals to the Steering Group on Food Surveillance and, where appropriate, to request publication of the results in Food Surveillance papers;

(f) Where necessary to request the Steering Group to refer the results obtained from these investigations to the appropriate expert committees.

REFERENCES

1. M. Peattie, D. H. Buss, D. G. Lindsay and G. A. Smart (1983). Reorganisation of the British Total Diet Study for monitoring food constituents from 1981. *Food Cosmet. Toxicol.,* **21**(4), 503–507.

2. D. H. Watson (1983). Review of the concentrations of anthelmintic substances in animal food products. *Food Chemistry,* **12**(3), 167–177.

3. D. J. Harwood, R. J. Heitzman and A. Jouquey (1980). A radioimmunoassay method for the measurement of residues of the anabolic agent, hexoestrol, in tissues of cattle and sheep. *J. Vet. Pharmacol. Therap.,* **3**, 245–250.

4. A. Hobson-Frohock, and J. A. Reader (1983). Determination of dimetridazole residues in poultry tissues by high performance liquid chromatography. *The Analyst* (London), in press.

5. J. E. L. Corry, M. R. Sharma and M. L. Bates (1983). Detection of antibiotic residues in milk and animal tissues. In: *Antibiotics: Methods of Assessing Antimicrobial Activity and the Occurrence of Resistance* (eds Russel, A. D. and Quesnel, L. D.) Soc. Appl. Bacteriol. Series No. 18, publ. Academic Press, London.

6. I. D. Herriman, D. J. Harwood, T. Blandford, and D. G. Lindsay, (1982). Distribution of hexoestrol residues in caponised chickens. *The Veterinary Record,* November 6th issue, 435–436.

7. Survey of Mercury in Food. First Report of the Working Party on the Monitoring of Foodstuffs for Mercury and other Heavy Metals. Ministry of Agriculture, Fisheries and Food. 1971. HMSO.

8. Survey of Lead in Food. Working Party on the Monitoring of Foodstuffs for Heavy Metals. Second Report. Ministry of Agriculture, Fisheries and Food, 1972. HMSO.

9. Survey of Mercury in Food: A Supplementary Report. Working Party on the Monitoring of Foodstuffs for Heavy Metals. Third Report. Ministry of Agriculture, Fisheries and Food. 1973. HMSO.

10. Survey of Cadmium in Food. Working Party on the Monitoring of Foodstuffs for Heavy Metals. Fourth Report. Ministry of Agriculture, Fisheries and Food. 1973. HMSO.

11. Survey of Lead in Food: First Supplementary Report. Working Party on the Monitoring of Foodstuffs for Heavy Metals. Fifth Report. Ministry of Agriculture, Fisheries and Food. 1975. HMSO.

12. Survey of Copper and Zinc in Food. The Fifth Report of the Steering Group on Food Surveillance. The Working Party on the Monitoring of Foodstuffs for Heavy Metals. Food Surveillance Paper No. 5. 1981. HMSO.

13. Survey of Arsenic in Food. The Eighth Report of the Steering Group on Food Surveillance. The Working Party on the Monitoring of Foodstuffs for Heavy Metals. Food Surveillance Paper No. 8. 1982. HMSO.

14. J. Haxton, D. G. Lindsay, J. Hislop, L. Salmon, E. J. Dixon, W. H. Evans, J. R. Reid, C. J. Hewitt and D. S. Jeffries (1979). Duplicate diet study in fishing communities in the United Kingdom: mercury exposure in a critical group. *Environ. Res.,* **10**, 351–58.

15. J. C. Sherlock, D. G. Lindsay, J. E. Hislop, W. H. Evans and T. R. Collier (1982). Duplication diet study of mercury intake by fish consumers in the United Kingdom. *Arch. Environ. Health,* **37**(5), 271–278.

16. J. C. Sherlock, G. A. Smart, C. B. Walters, W. H. Evans, D. J. McWeeny and W. Cassidy (1983). Dietary surveys on a population at Shipham, Somerset, UK. *Sci. Tot. Environ.* **29**, 121–142.

17. The Glasgow Duplicate Diet Study. Department of the Environment. Pollution Report No. 11. 1982.

18. J. C. Sherlock, G. A. Smart, G. I. Forbes, M. R. Moore, W. J. Patterson, W. N. Richard and T. S. Wilson (1982). Assessment of lead intakes and dose-response for a population in Ayr exposed to a plumbosolvent water supply. *Human Toxicol.,* **1**, 411–415.

19. M. J. Heard, A. C. Chamberlain and J. C. Sherlock (1983). Uptake of lead by humans and effect of minerals and food. *Sci. Tot. Environ.,* **30**, 245–253.

20. Survey of Cadmium in Food. First Supplementary Report. The Twelfth Report of the Steering Group on Food Surveillance. The Working Party on the Monitoring of Foodstuffs for Heavy Metals. Food Surveillance Paper No. 12. 1983. HMSO.

21. Survey of Lead in Food: Second Supplementary Report. The Tenth Report of the Steering Group on Food Surveillance. The Working Party on the Monitoring of Foodstuffs for Heavy Metals. Food Surveillance Paper No. 10. 1982. HMSO.

22. A. G. Shaper, S. J. Pocock, M. Walker, C. J. Wale, B. Clayton, H. T. Delves and L. Hinks (1982). Effects of alcohol and smoking on blood lead in middle-aged British men. *Brit. Med. J.,* **284,** 299–302.

23. Survey of Vinyl Chloride content of Polyvinyl Chloride for Food Contact and of Foods. The Second Report of the Steering Group on Food Surveillance. The Working Party on Vinyl Chloride. Food Surveillance Paper No. 2. 1978. HMSO.

23a. J. Gilbert, M. J. Shepherd, J. R. Startin and D. J. McWeeny (1980). Gas chromatographic determination of vinylidene chloride monomer in packaging films and foods. *J. Chromatogr.,* **197,** 71–78.

24. Survey of Vinylidene Chloride Levels in Food Contact Materials and in Foods. The Third Report of the Steering Group on Food Surveillance. The Working Party on Vinylidene Chloride. Food Surveillance Paper No. 3. 1980. HMSO.

24a. J. Gilbert and J. R. Startin (1982). Determination of acrylonitrile monomer in food packaging materials and in foods. *Food Chemistry,* **9,** 243–252.

25. Survey of Acrylonitrile and Methacrylonitrile Levels in Food Contact Materials and in Foods. The Sixth Report of the Steering Group on Food Surveillance. The Working Party on Acrylonitrile and Methacrylonitrile. Food Surveillance Paper No. 6. 1982. HMSO.

26. Survey of Styrene Levels in Food Contact Materials and in Foods. The Eleventh Report of the Steering Group on Food Surveillance. The Working Party on Styrene. Food Surveillance Paper No. 11. 1983. HMSO.

27. R. D. Coker, K. Jewers, N. R. Jones, J. Nabney and D. H. Watson (1983). U. K. Patent Publication No. 2188365A.

28. J. Gilbert, M. J. Shepherd and J. R. Startin (1983). A survey of the occurrence of the trichothecene mycotoxin deoxynivalenol (vomitoxin) in UK grown barley and in imported maize by combined gas chromatography-mass spectrometry. *J. Sci. Food Agric.*, **34**, 86–92.

28a. J. Gilbert, M. J. Shepherd, M. A. Wallwork and M. E. Knowles (1984). A survey of the occurrence of aflatoxin M_1 in UK produced milk for the period 1981–1983. *Food Additives and Contaminants,* **1**, (to be published).

29. R. W. Wenlock, D. H. Buss and E. J. Dixon (1979). Trace nutrients. 2. Manganese in British Food. *Brit. J. Nutr.*, **41**, 253–261.

30. R. W. Wenlock, D. H. Buss, R. E. Moxon and N. G. Bunton (1982). Trace nutrients. 4. Iodine in British Food. *Brit. J. Nutr.*, **47**, 381–390.

31. R. W. Wenlock (1982). The nutrient content of UK wheat flours between 1957 and 1980. *J. Sci Food Agric.*, **33**, 1310–1318.

32. The Fight for Food, British Agrochemicals Association Limited, p.3.

33. Report of the Working Party on Pesticide Residues (1977–1981). Food Surveillance Paper No. 9. 1982. HMSO.

34. MAFF (1982) Survey of dieldrin residues in food. Food Surveillance Paper No. 7. 1982. HMSO.

35. Hexachlorocyclohexane (HCH) residues in food and human tissues. Food Surveillance Paper No. 1984. HMSO. (To be published).

36. Polychlorinated biphenyl (PCB) residues in food and human tissues. Food Surveillance Paper No. 13. 1983. HMSO.

37. Royal Commission on Environmental Pollution, Seventh Report, Agriculture and Pollution. (Cmnd 7644) September, 1979.

38. F. Selenka, and D. Brand-Grimm (1976). Nitrat und Nitrit in der Ernahrung des Menschen, Kalkulation der Mittieren Tagesanfrahome und Abschatzung der Schwankungsbreck. *Zbl. Bakt. Hyg. I. Abt. Orig. B.*, **162**, 449–466.

39. W. Edel, G. J. Kramers, J. J. L. Pieters, L. J. Schuddeboom and T. Staarink (1980). Surveillance Programme, man and nutrition. publ. Government Publishing Office, Den Haag, Nederlands.

40. M. Jagerstad and R. Nilsson (1976). Intake of nitrate and nitrite of some Swedish consumers as measured by the duplicate portion technique. Proc. 2nd Int. Symp. Nitrite Meat Prod., Zeist 1976 Pudoc Wageningen pp. 283 to 287.

41. E. Tremp (1980). Dietary nitrate burden of the Swiss population. *Mitt. Gebiete Lebensm. Hyg.*, **71**, 182–194.

42. Royal Society Report on *The Nitrogen Cycle of the United Kingdom.* Carlton House Terrace, London, January 1984.

43. Food Additives and Contaminants Committee (1978). Report on the Review of Nitrates and Nitrites in Cured Meats and Cheese, FAC/REP/27, HMSO.

44. Great Britain: Parliament (1982). The Preservatives in Food (Amendment) Regulations 1982. Stat. Instrum. No. 15. HMSO.

45. G. J. Hunt. Ministry of Agriculture, Fisheries and Food, Directorate of Fisheries Research. Aquatic Environment Monitoring Report No. 8. Radioactivity in Surface and Coastal Waters of the British Isles, 1980. Lowestoft 1982, ISSN 0142-2499.

46. W. R. Bradford, E. J. C. Curtis and O. Popplewell, (1984). Radioactivity in environmental samples taken in the Sellafield and Ravenglass areas of W. Cumbria - 1977–1982. *Sci. Tot. Environ.*, (in press).

47. World Health Organisation (1983). Guidelines for the study of dietary intakes of chemical contaminants. Report No. WHO-EFB 83.53, World Health Organisation, Geneva.

48. A. Preston and J. E. Portmann (1981). Critical path analysis applied to mercury inputs to the UK coastal waters. *Environ. Pollut.*, **2**, 451–464.

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